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Second in a series of articles discussing the management of backlog

The first article in this series, “Essential Elements of Backlog Measurement and Analysis,” defined backlog as the classification of work that, for whatever reason, has not been completed.

Measuring backlog allows a manager to set priorities. As previously stated, because backlog is measured in planned hours, providing estimated durations for backlog work orders determines the accuracy of the end data and the decisions that can ultimately be made.

Workload backlog is commonly measured in hours. But this means almost nothing without the use of a second method of measurement in weeks.
In theory, measuring backlog in weeks gives the supervisor an idea of how long he can keep personnel employed with the current amount of backlogged work. How is this determination made? This issue has several schools of thought. For this example, assume a maintenance shop has 10 technicians available for work.

Backlog weeks based on credit hours earned
The first of these schools is the measurement of backlog against the performance of work for the prior period of work. If this group of technicians completed only 350 planned hours in the prior week, then the current backlog is worth around 10 weeks of employment for that shop.

This method has some specific problems. In order to provide an accurate measurement of any value, there must be a stable comparison value to calculate it against. This method uses two moving values to produce the weeks measurement. First, the hours of backlog increase and decrease with the amount of demand for service and performance of work. Since this is the value being measured into the weeks method, it is not the problem with this method of calculation.

Second is the use of the total earned hours for the prior week. If backlog hours are continually moving up and down and productive labor earnings are doing the same, using this value is a sure way of causing confusion to anyone trying to interpret its meaning and validity. Fig. 1 shows that the effect of attempting to evaluate backlog weeks in this manner produces an erratic and unpredictable measurement. Thus, this method of calculating the weeks value is not only highly volatile but also extremely inaccurate.

Backlog weeks based on payroll hours expended

The second method of calculating the weeks measurement is much like the first except that it attempts to evaluate the backlog weeks using another moving number which represents the amount of payroll hours that were actually expended on the jobs performed for the prior reporting period (Fig. 2).

This method has the same problems as the first method with an added bonus—the unpredictable hours of overtime and double time can significantly skew the data.

Backlog weeks based on regular payroll hours available

The third method of calculating the weeks of backlog resolves the two moving numbers problem of the first method, producing a more stable backlog effect. But the method still is problematic (Fig. 3).

The method is based on the division of the backlog hours by the amount of annual regular hours for the group of technicians performing the work. So, if we take the 10 maintenance technicians who work 40 scheduled hours each period and divide the current backlog hours by their scheduled time we get around 9 weeks of backlog availability.

The problem with this method is that, while resolving the two moving numbers problem, it is based on the total amount of regular hours that the organization will pay the technician during this period. It does not take into account the availability of the employee due to paid holidays, vacations, and sick leave, not to mention the performance requirement. The paid time off variables can significantly skew the weeks measurement since this is time that can, at any given moment, reduce the scheduled regular hours of the technician. The performance requirement is more complicated, but it is essentially the amount of variation the organization allows between the planned amount of work and the actual performance of that work.

A complete and accurate method for calculating the weeks measurement is to take the basic elements of the prior three methods and resolve their problems.

Backlog weeks based on average availability of hours

With the moving number problem being solved by method number three, the paid time off variable needs to be addressed. In addition to the known items with the maintenance shop, these employees enjoy an average of about 15 days of paid vacation, 10 paid holidays, and have an allowance of 13 paid sick days per year. Now this information can help to produce an availability factor.

I prefer the worst-case scenario. The worst-case scenario assumes that every technician will take all the paid vacation, holidays, and sick time available throughout the year. This is a good practice since, if you plan for the maximum deviation of the variables involved in calculating this measurement, you can only do better than the worst case. Hope for the best, but plan for the worst.

The availability factor involves averaging the effect of the annual paid time off variables across the year and producing a modified average availability for the technician for each pay period. This produces the ideal available hours value.

Once the ideal available hours have been figured it will have to be adjusted once more to include the performance requirement of the organization. This involves deciding how much of the work must be planned in advance, what is the minimum performance required for planned work, and how much of a credit penalty should be assessed should a work order be performed without advance planning or using a pre-plan for similar jobs. These are entirely organizational issues and can vary greatly.

The required performance adjustment involves evaluating the value of planned/unplanned work.

Next, the required performance adjustment is applied to the ideal available hours and produces a final value representing the total credit hour capability for each pay period for the shop. Finally, the total backlog hours are divided by the maintenance shop's credit hour capability to complete the figuring of backlog weeks (Fig. 4).

While this method is somewhat lengthy to implement into the weeks measurement, it is the necessary, final step in taming an otherwise wild calculation and setting the bar for stable backlog analysis and decision-making.

A future article in this series will cover backlog analysis. **MT**

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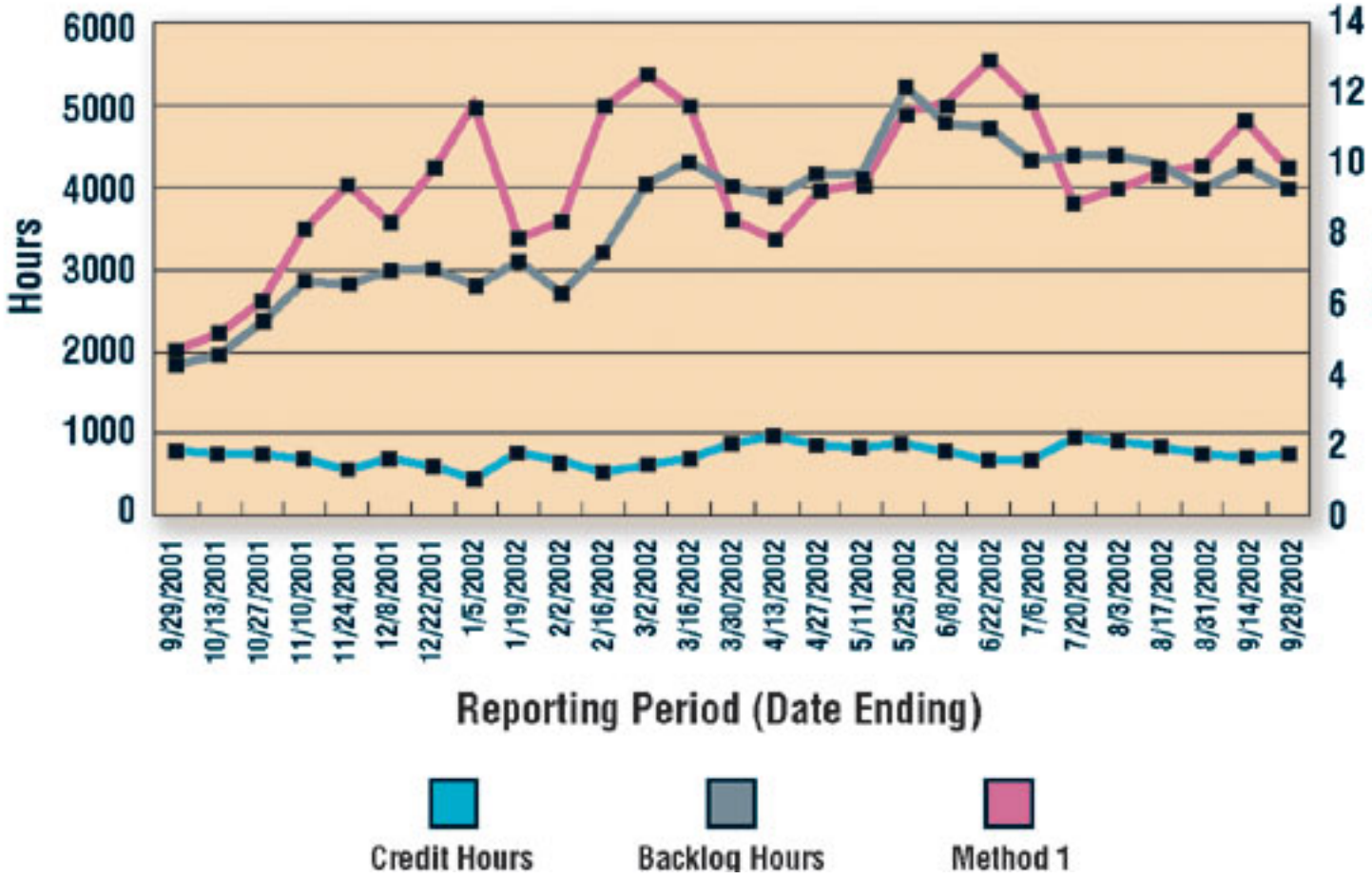
Method 1. Backlog Hours Divided by Credit Hours



$$\text{Backlog weeks} = \frac{\text{Current backlog hours}}{\text{Earned credit hours for prior week}} = \frac{3590}{350} = 10.25 \text{ weeks}$$

Fig. 1. Backlog weeks determined by credit hours earned in the prior reporting period.

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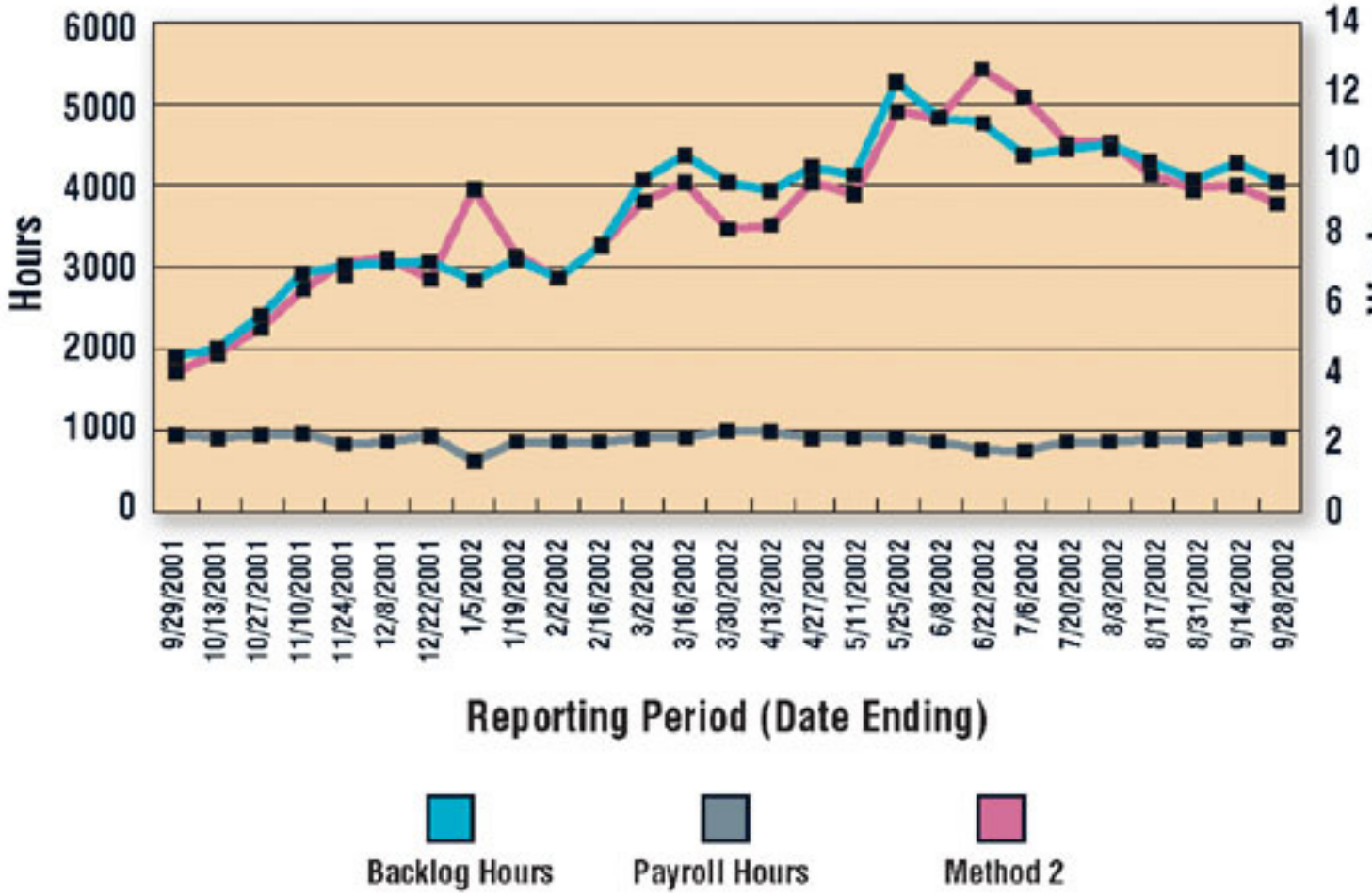
Method 2. Backlog Hours Divided by Expended Payroll Hours



$$\text{Backlog weeks} = \frac{\text{Current backlog hours}}{\text{Expended labor hours for prior week}} = \frac{3590}{451} = 7.96 \text{ weeks}$$

Fig. 2. Backlog weeks determined by payroll hours used from the prior reporting period.

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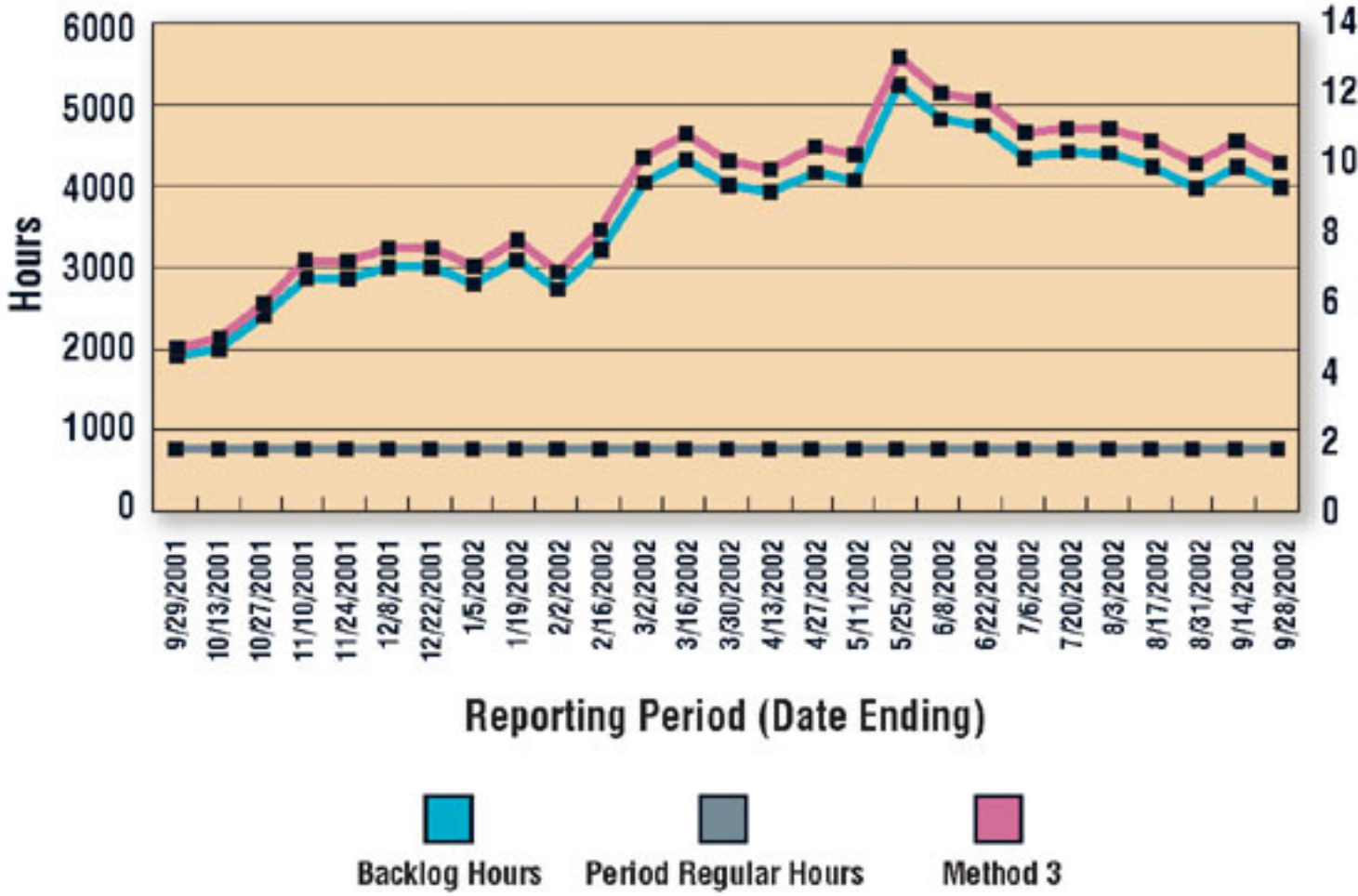
Method 3. Backlog Hours Divided by Regular Hours Available



$$\text{Backlog weeks} = \frac{\text{Current backlog hours}}{\text{Current technicians * weekly payroll hr per technician}}$$

$$= \frac{3590}{(10*40)} = 8.975 \text{ weeks}$$

Fig. 3. Backlog weeks determined by the total regular hours available per reporting period.

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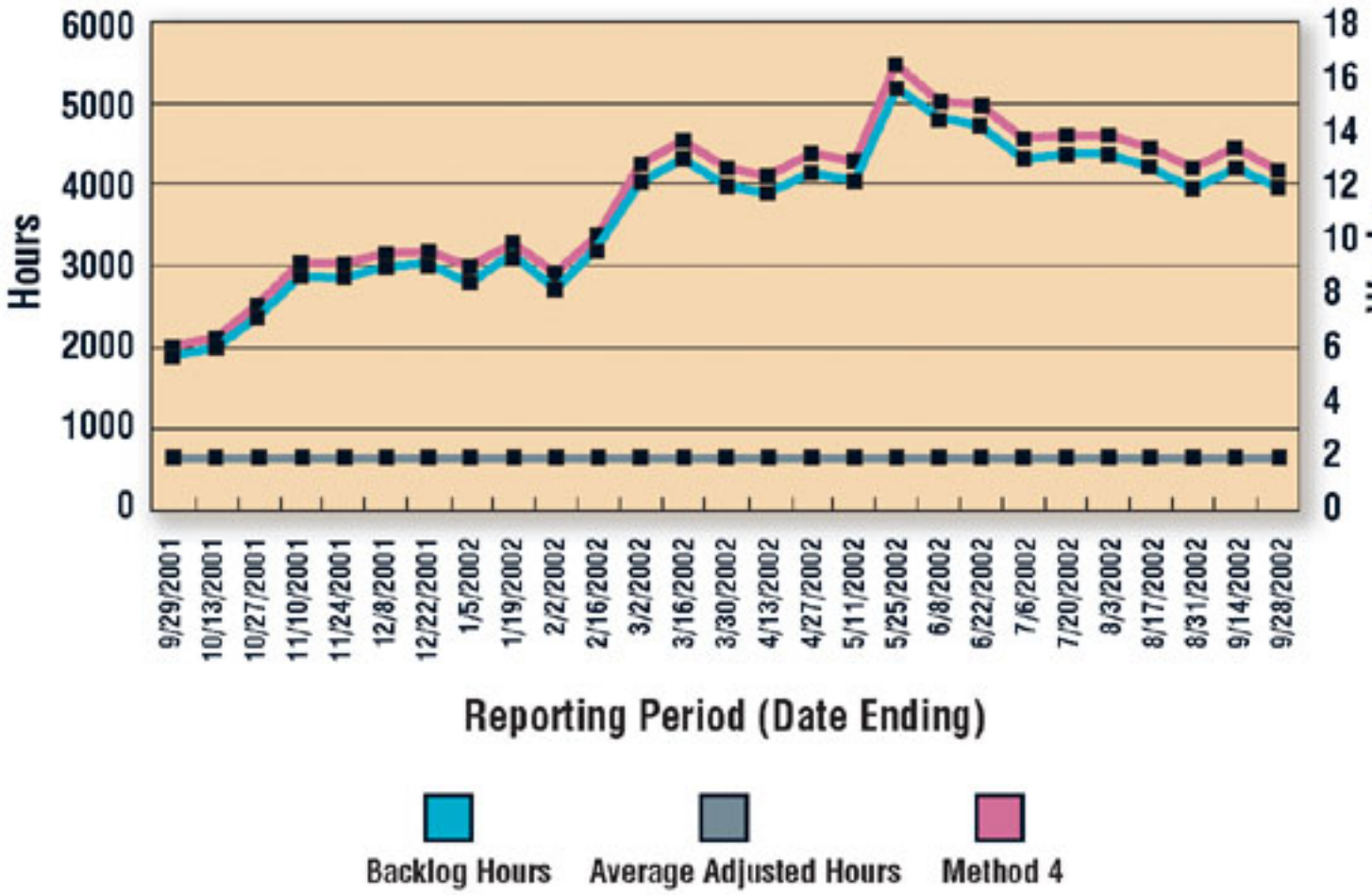
Method 4. Backlog Hours Divided by Average Available Hour


Hours
6000
5000
4000
3000
2000
1000
0
18
16
14
12
10
8
6
4
2
0
9/29/2001
10/13/2001
10/27/2001
11/10/2001
11/24/2001
12/8/2001
12/22/2001
1/5/2002
1/19/2002
2/2/2002
2/16/2002
3/2/2002
3/16/2002
3/30/2002
4/13/2002
4/27/2002
5/11/2002
5/25/2002
6/8/2002
6/22/2002
7/6/2002
7/20/2002
8/3/2002
8/17/2002
8/31/2002
9/14/2002
9/28/2002
Reporting Period (Date Ending)
Backlog Hours
Average Adjusted Hours
Method 4

Annual regular hours =
Weekly regular payroll hr per technician * annual weeks per year
40 * 52 = 2080 hours

Annual paid time off =
(Paid holidays + paid vacation + paid sick time) * 8
(10 + 15 + 13) * 8 = 304 hours
(8 regular payroll hours per day based on 5-day, 40-hr workweek)

Ideal available hr per week =

$$\frac{\text{Annual regular hrs} - \text{annual paid time off}}{\text{Annual weeks per year}}$$

$$\frac{2080 - 304}{52} = 34.15 \text{ hours}$$

Value of planned work =
Planned work requirement * required performance on planned work
90% * 95% = 85.5%
(planned work requirement is the percentage of expended labor hours required on planned work)

Value of unplanned work =
Unplanned work allowance * (value of planned work * unplanned labor penalty)
10% * (85.5% * 85%) = 7.26%
[unplanned work allowance is the amount of expended labor hours that can be used on unplanned work (100% – planned work requirement); unplanned labor penalty is the credit hour penalty for unplanned labor hours used]

Required performance adjustment =
Value of planned work + value of unplanned work
85.5% + 7.26% = 92.76%

Weekly credit hr capability =
Ideal available hours * required performance adjustment
34.15 * 92.76% = 31.68 hours

Calculated backlog weeks=

$$\frac{\text{Current backlog hours}}{\text{Number of technicians * technician weekly credit hr capability}}$$

$$\frac{3590}{(10 * 31.68)} = 11.33 \text{ weeks}$$

Fig. 4. Backlog weeks determined by availability factor.

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